Food System Futures

The Dynamics of 9 Billion People Eating Well on a Resource Scarce Planet

Ideas Paper

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How do we transform agri-food systems over the coming decades to make environmental sustainability, health and inclusive growth a reality?

Context

If current trends continue, by 2050 we will need 2.3 planets earth's to meet our demands on natural resources. "Today our societies are on a dangerously unsustainable track". This is the hard-nosed prognosis of the World Business Council for Sustainable Development.

In early 2011 the British Foresight Commission released its report on "The Future of Food and Farming". It identified a raft of pressures on the global food systems including increasing demand, declining soil fertility, water scarcity, and the impacts of climate change. It concluded that "any one of these pressures ('drivers of change') would present substantial challenges to food security; together they constitute a major threat that requires a strategic reappraisal of how the world is fed".

Across business, government, civil society organisations and the science community the consensus is clear - over the coming decades there must be profound changes in the global agri-food system. Business as usual is simply not an option. The underlying trends and emerging risks are relatively clear. However, we remain very far from understanding **how** to bring about the scale and speed of transformation that will be needed.

Purposefully steering a transition from unsustainable to sustainable agri-food systems will require a feat of human ingenuity that goes well beyond present capabilities. While endowed with a great capacity for technological development we are still on a very steep learning curve when it comes to the challenges of adapting socially, politically and economically to resource scarcity.

Human social, economic and technological history has been characterised by a series of often dramatic 'transitions'. However, past transitions - the mechanisation of agriculture, the use of external inputs, the growth of supermarkets and the globalisation of supply chains – have evolved in largely undirected ways on the back of technological advances and in response to unplanned socio-economic factors. Now, however, we are talking about a very different type of transition. Departing from the current 'dangerously unsustainable track' implies a purposeful and goal driven transition.

Critical Trends for Understanding Transitions in Global Agri-Food Systems

- Global population growing to 9 billion
- Demographic changes leading to increased demand for high protein diets
- Rapid urbanisation with more poor and food insecure people living in cities
- Soil degradation
- Declining fertiliser resources
- Changing, unpredictable and unstable climate conditions
- Increasing severity of natural disasters
- Increasing wealth inequalities, especially between rural and urban populations
- Scarcity of water resources and water related conflicts
- Obesity and unhealthy diet and lifestyles
- Globalisation of procurement
- Increasing penetration of supermarkets
- Collapse of north/south and developed/developing dichotomies

How realistic is such a degree of 'steered' change? And, if it is realistic what will be the drivers, the incentives and the innovation mechanisms?

Systemic Change

A starting point for exploring such questions is to recognise that our social, economic, political and natural worlds are all ***complex adaptive systems***. They change and evolve in unpredictable ways functioning as a complex network of interlinked elements (agents). They are not controlled or directed by top-down plans or hierarchies of decision makers. Yet, historically our political, policy making and scientific institutions have indeed often assumed false degrees of linearity, simplicity of cause and effect relations, along with unrealistic possibilities for hierarchical control and command. Coming to terms with the dynamics of change in complex systems will be critical for the emerging transition agenda in the agri-food sector.

Connecting the Dots – Population Growth, Demographics, Resources and Politics

Of the projected population growth of 3 billion 1 billion will be in Africa, 1.5 billion in Asia and 0.25 billion in Latin America. This will also coincide with mass urbanisation with 70% of the world's population living in cities by 2050. Asia's vast population with rapidly increasing wealth will have massive resource requirements. Land for agricultural expansion exists predominantly in Africa and Latin America. These factors will collide to create new political economic dynamics with significant risks and opportunities poorer countries who have underutilised agricultural resources.

Further, the nature of complex systems is not all with which we have to reckon. The other side of the coin is how humans function cognitively. Over the last couple of decades developments in cognitive science have led to a much more sophisticated understanding of how we 'make sense' of our worlds and where the powers and limitations of the human brain lie. For example, there is a deep human tendency, that becomes embedded in our institutions, not to see, accept and own up to failure. Yet high degrees of failure are inherent in the evolution in complex systems. This cognitive limitation constrains feedback mechanisms and slows down our adaptive capacities, too often making us blind until crisis hits. In terms of global agri-food systems the consequences of waiting for crisis to be the instigator of serious change would be dire. It risks a scale of ecosystem collapse that may make the world largely uninhabitable.

Tackling the challenge of transitions in the global agri-food system will require approaches underpinned by a radical rethinking of innovation and change. Technological innovation needs to brought together with a new vision on institutional innovation that better integrates the sciences of complexity and human cognition.

"Business, consumers and policy-makers will experiment, and, through multi-stakeholder collaboration, systemic thinking and co-innovation, find solutions to make a sustainable world achievable and desirable. This is opportunistic business strategy at its best."

World Business Council for Sustainable Development
2050 Vision

Dimensions of Transformation

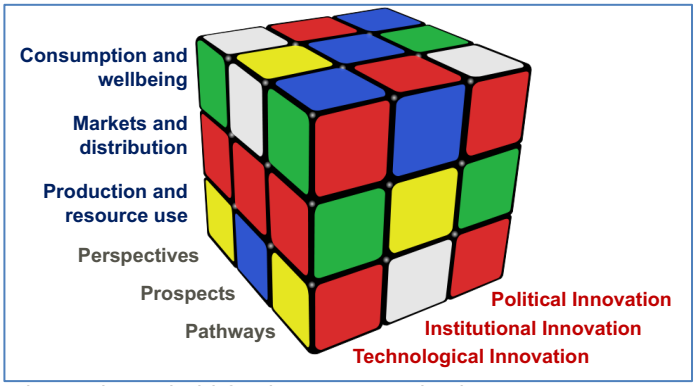
Food System transformation will require a multi-dimensional response. Figure 1 provides a map for exploring these different dimensions[1].

Along the Y axis Agri-food transitions can be looked at in terms of **consumption**, **markets**, and **production**. Historically the agriculture sector has focused a great deal on increasing production. In the future this will be necessary, but alone it will not be enough. For example, consumption patterns, particularly in relation to protein consumption will have to be considered. Market mechanisms to ensure minimal waste and low carbon foot prints will be essential.

"Agriculture is a principal platform for human development and social welfare. It is the foundation upon which diverse economies have been built and provides a pathway out of poverty for millions."

World Economic Forum – Realising a New Vision for Agriculture

[1] Model originally developed jointly with Bram Huijsman



The X axis illustrates that transitions involve three core process elements. One, working with multiple different **perspectives** that stakeholders have about future trends and risks and what for them would be desirable improvements. Debates and conflicts over the 'reality' of climate change, the risks of GMOs or how 'free' markets should be show the importance of recognising different perspectives. Two, for change, **prospects** are needed. For example, ways of reducing household food waste, supply chain management mechanisms that reduce greenhouse emissions or new plant varieties that enable quick adaption to climate change. Creating prospects requires innovation and creative thinking, effective use of research findings and the capacity for coupling of science with 'problem owners' and policy makers. Three, prospects mean little if they are not 'mined'. **Pathways** of change are needed to test out prospects and bring about the desired transformations. Pathways involve looking carefully at the motives and incentives for people to behave differently and how effective feedback mechanisms can be created.

On the Z axis is **technological, institution and political innovation**. Both 'hardware' and 'software' will be critical to change in food systems. Yet, too often these dimensions are not well integrated. Further, knowledge institutions and research practices face significant challenges to function in ways that enable them to move beyond 'research' and become active brokers of innovation and change.

Examples of Perspective Questions

- What does climate change mean for agricultural productivity in different regions?
- What will population growth and demographic changes mean for food and resource demands?
- Who will be poor in the future and where will they live?
- What role for small-scale producers in future production systems?
- Which regions of the world have the greatest production potential and who will control these resources?
- What will be the impact of emerging economies on agri-food systems?
- What will be the impact of obesity and unhealthy lifestyles?
- What balance between local and global sourcing?
- What are the future risks from animal diseases?
- Who wins, who loses or where are there win wins for different scenarios?
- In what regions and in what ways can the world increase production?

Examples of Prospect Questions

- How can supply chain logistics reduce carbon footprints?
- What are alternatives to animal protein for 9 billion people?
- What radical alternatives exist for large scale non-traditional food production?
- How can production potential in Africa be realised?
- What policy mechanisms are needed to drive inclusive agri-food business?
- What metrics can be used to monitor transitions?
- How can ICT be used to improve production and market efficiencies?

Examples of Pathway Questions

- How can the big issues of agri-food dynamics be understood and communicated?
- What are effective motivators and incentives for change?
- How can innovation be effectively brokered?
- What is the future role of standards, certification and premiums?
- How can externalities be factored into markets?
- Who pays when public goods and private interests overlap?
- How can partnerships and multi-stakeholder collaboration be made as effective as possible?

> *"The transformation ahead represents vast opportunities in a broad range of business segments as the global challenges of growth, urbanization, scarcity and environmental change become the key strategic drivers for business in the coming decade."*
>
> World Business Council for Sustainable Development
> 2050 Vision

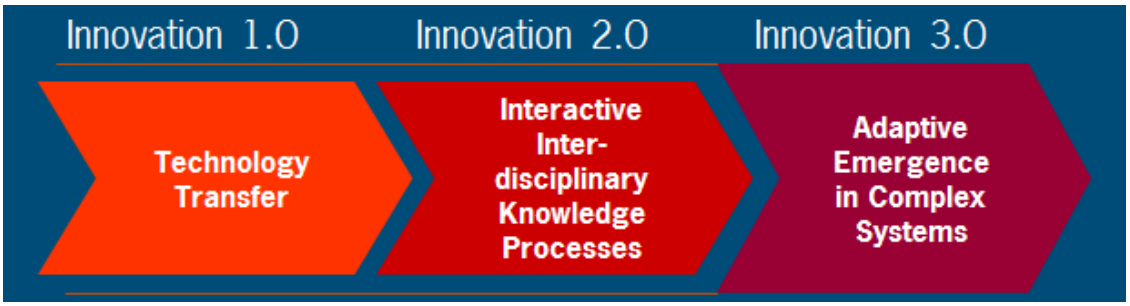
Opportunities or Threats?

Future scenarios for the global agri-food system are often presented from a crisis and threat perspective. Current trends should certainly be ringing alarm bells. However, making change requires finding opportunities for constructive improvements that inspire innovation and action. As articulated by the World Business Council making the change offers many business opportunities.

Key Threats	Key Opportunities
• Inability to meet overall global food demands • Food insecurity for poor and marginalised rural groups due to land scarcity and degrading resources • Food insecurity for growing urban poor populations due to poverty and increasing food prices • Increasing economic marginalisation for rural and urban poor linked with social and political unrest • Famine caused by climate linked natural disasters	• Market opportunities from 3 billion more people and rapidly developing middle class populations • Development of products and services to serve 'bottom of the pyramid' consumers • Sustainability products and services • Cost efficiencies from more sustainable supply chains • Improved infrastructure and business climate in emerging economies • Creation and marketing of healthy products • Waste recycling • Carbon sequestration

Towards Innovation 3.0

As illustrated in Figure 2, innovation processes in the agri-food sector can be seen has having evolved through three main paradigms.



Innovation 1.0 was characterised by the idea of technology transfer. Essentially, that researchers develop new technologies that are then be extended to farmers (and other end users) by extension agents.

Innovation 2.0 is characterised by recognition of interdisciplinary approaches and the importance of working with end-users as co-creators of innovation. Much emphasis was given to collaborative learning between different stakeholders and with researchers and extension agents being part of the 'learning system'.

Innovation 3.0 is an emerging paradigm characterised by much greater attention for what it means to work within complex adaptive systems and a deeper understanding of how the human brain actually functions. Key features of an innovation 3.0 paradigm include:

- Recognizing the dynamics of complex social, economic and natural systems
- Recognizing ethical dilemmas and need for value oriented change
- Giving equal attention for technological and institutional innovation
- Dealing explicitly with power and politics
- Using methods that align with human cognitive and emotional processes
- Fosters learning networks through emerging technologies (web 2.0)
- Fostering entrepreneurial approaches to innovation and change

As illustrated by the figure, Innovation 3.0 is an evolution of early approaches that integrates their strengths and lessons. Technological developments and enabling their uptake remains critically important as do interdisciplinary and learning oriented approaches. However, they need to be set within a wider context of issues and approaches to innovation and change.